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February 14, 2020

Mr. Chan Pongkhamsing  
EPA Remedial Project Manager  
U.S. EPA Region 10  
1200 Sixth Avenue, ECL 111  
Seattle, WA 98101

RE: Acid Sump Area Source Area Remedial Design Work Plan

Dear Mr. Pongkhamsing:

Please find the enclosed copy of the Final *Acid Sump Area Source Area Remedial Design Work Plan*.

If you have any questions, please feel free to contact me at 541.812.7376.

Sincerely,

A handwritten signature in blue ink, appearing to read "Noel Mak", with a stylized, cursive script.

Noel Mak  
NPL Program Coordinator

Enclosures: 1. *Acid Sump Area Source Area Remedial Design Work Plan*

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# **Acid Sump Area Source Area Remedial Design Work Plan**

*ATI Millersburg Operations, Oregon*

February 2020

Prepared by



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**Acronyms and Abbreviations**

µg/L	microgram per liter
µS/cm	micro Siemens per centimeter
ATI	ATI Millersburg Operations (Oregon)
bgs	below ground surface
C	Celsius
CWTS	central wastewater treatment system
CVOC	chlorinated volatile organic compound
DCA	1,1-dichloroethane
DCE	1,1-dichloroethene
DEQ	Oregon Department of Environmental Quality
DNAPL	dense nonaqueous-phase liquid
DO	dissolved oxygen
EISB	enhanced in-situ bioremediation
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
GETS	Groundwater Extraction and Treatment System
gpm	gallons per minute
HSP	health and safety plan
ID	inside diameter
IDW	investigation derived waste
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligram per liter
mL	milliliter
OAR	Oregon Administrative Rule
ORP	oxidation-reduction potential
PCE	tetrachloroethene
PID	photoionization detector
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
ROD	Record of Decision
SC	specific conductance
Site	ATI facility

SLEP	Schmidt Lake Excavation Project
TCA	1,1,1-trichloroethane
TCE	trichloroethene
USCS	Unified Soil Classification System
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound
YSI	Yellow Springs Instruments

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# 1. Introduction

This Remedial Design Work Plan (Work Plan) presents a scope for additional source area investigation in the Acid Sump Area, which is located in the Fabrication Area of the ATI Millersburg Operations (Oregon) (ATI) facility (Site), formerly ATI Wah Chang (Figure 1). The 1993 remedial investigation/feasibility study revealed the presence of chlorinated volatile organic compounds (CVOCs) in Acid Sump Area groundwater above U.S. Environmental Protection Agency (EPA) National Primary Drinking Water maximum contaminant levels (MCLs; CH2M HILL, 1993)<sup>1</sup>, and the Record of Decision (ROD) for the Site (EPA, 1994) prescribed the actions that ATI needed to take to mitigate the CVOCs.

In 2002, a Groundwater Extraction and Treatment System (GETS) began removing CVOCs from the Acid Sump Area groundwater through extraction well FW-3 (see Figure 1 for well locations). ATI attempted to install an additional extraction well (FW-8) in the Acid Sump Area in 2007, but encountered a source of 1,1,1-trichloroethane (TCA) and abandoned the well boring (GSI, 2017). ATI determined that injecting nutrients to accelerate microbial degradation of CVOCs would be more effective at treating the source area and downgradient plume. EPA issued an Explanation of Significant Differences (ESD) to the 1994 ROD that allowed enhanced in situ bioremediation (EISB) as part of the remedy for the Site (EPA, 2009). In 2009, EISB was implemented with a biobarrier (located downgradient of the source area) and hydraulically controlled injections (in the source area) consisting of injectate materials designed to enhance reductive dechlorination. Specifically, ATI injected an emulsified soybean oil and sodium lactate blended compound (substrate), buffering agent (to maintain pH above 6), and dechlorinating bacteria to degrade CVOCs (GSI, 2015). In 2016, ATI performed additional source area remediation by excavating approximately 500 cubic yards of CVOc-contaminated soil from the Acid Sump Area in the vicinity of FW-8 (GSI, 2017). The excavation was designed to address the TCA-impacted soil that was encountered in FW-8.

Despite dramatically reduced concentrations of CVOCs in the contaminant plume, groundwater quality data collected during the biannual groundwater sampling conducted in 2018 suggest that a persistent source of dense nonaqueous-phase liquid (DNAPL) may exist in the Acid Sump Area. As such, ATI plans to implement additional remediation in the Acid Sump Area to achieve the groundwater cleanup standards in the ROD (EPA, 1994). To efficiently and cost effectively implement the remediation, further source area investigation and remediation feasibility analysis are necessary to fill data gaps.

This Work Plan consists of a historical records review and field work that ATI will conduct to address data gaps and to inform the nature and scope of future source remediation in the Acid Sump Area. This Work Plan has been designed to meet the following objectives:

1. Locate subsurface features that may affect the feasibility of source zone remediation by injection of remedial agents.

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<sup>1</sup> Trichloroethene (TCE) and (TCA) are the primary parent CVOCs in the Acid Sump Area. Groundwater samples collected during the 2018 groundwater quality monitoring events indicate that concentrations of tetrachloroethene (PCE); 1,1-dichloroethene (DCE); 1,1-dichloroethane (DCA); vinyl chloride (VC); fluoride; and nitrate exceed MCLs.

2. Delineate, to the extent feasible, the source zone based on groundwater quality samples collected from temporary borings.
3. Determine the radius of influence of injectate that can be introduced to the source zone at a given point using a tracer test (if groundwater quality data indicate the need for tracer analysis because of DNAPL or high CVOC zones).
4. Assess the performance of injection and extraction wells that were installed and used during the 2009 EISB and the need for additional wells if recirculation of injectate is determined to be a potentially viable option for a future EISB approach.

This Work Plan is organized as follows:

- **Section 1 – Introduction.** Provides an overview of the Site history, and the purpose and objectives of the scope described in this Work Plan.
- **Section 2 – Data Gaps Investigation.** Identifies data gaps, and describes the records review and field work that will be conducted to address data gaps.
- **Section 3 – Sampling Protocols.** Provides standard operating procedures for conducting field work (e.g., sampling methods, sample naming conventions, etc.).
- **Section 4 – Reporting.** Describes the documents that will be prepared as a part of this additional investigation, and future remediation in the Acid Sump Area.
- **Section 5 –References.**

## 2. Data Gaps Investigation

ATI anticipates that future remediation in the Acid Sump Area will involve injecting remedial agents into subsurface soils to remediate CVOC sources (i.e., DNAPL and elevated concentrations of CVOCs, called the “source zone” in this Work Plan). The following data gaps must be addressed to inform the nature and scope of future source zone remediation:

- Location of subsurface features (e.g., utility corridors and structural piles) that could affect injectate movement.
- Areal extent of the source zone.
- Feasibility of introducing injectate to source zones that are present beneath structures. Specifically, this is referring to introducing injectate beneath the aboveground storage tanks area (not adjacent buildings).
- Performance of existing injection and extraction wells installed in 2009, the need for additional wells, and viability of using recirculation for remedial approach.

Before initiating field work, ATI will prepare a Health and Safety Plan (HSP) that covers the activities that will be used to address data gaps.

## **2.1 Location of Subsurface Features that Could Affect Remediation**

The effectiveness of remediation may be affected by subsurface features that act as preferential pathways for the movement of injectate, or that affect drilling locations.

### **2.1.1 Data Gap Description**

The Site has been through several operational changes over time that have resulted in installation and abandonment of process pipelines, vaults, and tanks, and changes in surface grades resulting in fill with the potential for buried debris. The locations of these features may be preferential pathways or obstructions that affect movement of injectate in the subsurface. For example, the 2009 EISB injectate surfaced at Outfall 2, traveling through an active sewer line. In addition, groundwater and soil samples collected from the Acid Sump Area suggest that a source zone may be present beneath existing structures (see Section 2.2). Existing structures may have sub-grade features that should be considered before drilling beneath the structure. For example, angle borings, which may be necessary to assess the presence of source zone beneath the acid tanks pad, should be advanced only after as-built diagrams have been reviewed to ensure that drilling will not affect structural piles, foundations, or supports.

### **2.1.2 Methods for Addressing Data Gap**

The existing infrastructure investigation will be performed using a records review and non-destructive investigative techniques. The records review will consist of interviewing personnel familiar with utility locations at the Site and review of as-built plan drawings available for the Acid Sump Area. Given the long operational history of the Site, limited usable information may be obtained or information may indicate gaps in data. ATI will review existing ground-penetrating radar, electro-magnetic sensor detection data, and any other utility surveys performed, and recommend whether additional surveys are necessary.

## **2.2 Areal Extent of Source Zone**

While previous investigations and remedies (conducted from 2009 to the present) helped to further refine ATI's understanding of the extent of CVOCs in Acid Sump Area groundwater, further evaluation is still needed to refine the boundaries of the current source zone, and ensure that any additional injections focus on addressing the potential source location.

### **2.2.1 Data Gap Description**

High concentrations of TCA in Acid Sump Area groundwater (including historical data collected from temporary wells and current data collected from existing monitoring wells) are shown in Figure 2. The grey-shaded data were collected more than 10 years ago and are likely not representative of current groundwater conditions. However, the data are shown in Figure 2 for completeness.

The groundwater concentrations indicate that DNAPL may be present in the Acid Sump Area<sup>2</sup>. Based on the groundwater concentrations in Figure 2, additional source zones may be present to the south, east, and northeast of the 2016 excavation area. This assumption is supported by sidewall soil samples from the 2016 source area excavation (shown in Figure 3), which indicate elevated concentrations of TCA on the north, east, and south sides of the excavation.

## 2.2.2 Methods for Addressing Data Gap

ATI will collect data to further delineate the areal extent of the source zone by advancing temporary borings, logging soils, and collecting groundwater samples for analysis of CVOCs within the boundaries of the area shown in Figure 4. This data gap investigation is focused on the Linn Gravel because the underlying Spencer Formation is an aquitard, as indicated by regional-scale studies on the Spencer Formation (e.g., Frank, 1974), site-scale vertical permeability testing (the hydraulic conductivity of the Spencer Formation ranges from 0.01 feet per day to 0.00001 feet per day at ATI)<sup>3</sup>, and previous investigations in the Acid Sump (i.e., Spencer Formation penetrated by drilling equipment has been “dry”). Because the Spencer Formation is an aquitard, it is unlikely to contain residual DNAPL.

CVOC concentrations in groundwater will be analyzed by an onsite, mobile laboratory (e.g., Libby Environmental in Olympia, Washington), and successive temporary boring locations will be selected on the basis of analytical results. The purpose is to define future treatment areas and the extent of elevated CVOC impacts, which include DNAPL and higher concentration zones that serve as a source for downgradient groundwater impacts. The following bullets describe the methods that will be used to further delineate the source zone in greater detail.

- **Temporary Boring Installation.** ATI will advance temporary vertical borings and angle borings in the “General Boring Investigation Area” shown in Figure 4. Initial boring locations will be advanced in the “General Boring Investigation Area” based on historical concentrations and subsequent boring locations will be dependent on the real time data obtained from a mobile laboratory. Step-out borings from potential DNAPL detection locations (groundwater concentrations >1 percent of CVOC constituent solubility limits) shall be no further than 10 feet from the original boring and in all four directions, unless there is an existing boring or Site infrastructure limits delineation in a particular direction. ATI anticipates that approximately 3 field days will be required to assess the limits of the source zone. Boring locations will be air-knifed to 5 feet below ground surface (bgs) to ensure no subsurface utilities are intercepted during drilling. Based on historical data collected for profiling excavation spoils during installation of infrastructure throughout the Site over time, impacts shallower than 5 feet from historical operations at the ASA are not anticipated. As such, no logging of air-knifed soils will be conducted.

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<sup>2</sup> A rule of thumb for DNAPL delineation is that groundwater concentrations exceeding 1 percent of a chemical's solubility in water may be indicative of DNAPL (EPA, 1992). Therefore, based on a TCA solubility in water of 1,290,000 micrograms per liter (µg/L) (Horvath and Getzen, 1999), groundwater concentrations exceeding 12,900 µg/L are considered to be indicative of DNAPL.

<sup>3</sup> See Table 4-18 of CH2M Hill (1993).

Borings will be advanced to the top of the Spencer Formation (approximately 15 to 17 feet bgs dependent on location) using the direct-push drilling method with 2.25-inch drill rods. Soils from the borings will be continuously logged according to the Unified Soil Classification System (USCS) under the supervision of an Oregon-licensed geologist, and will be examined visually and with a photoionization detector (PID) for evidence of DNAPL or elevated CVOC concentrations. Soil samples for analysis of CVOCs may be collected if unsaturated zone soils exhibit evidence of significant impacts. However, as groundwater samples will be more representative of source zone impacts below the water table, soil collection and analysis likely will be limited to vadose zone soils with indications of significant impacts.

- **Temporary Boring Groundwater Sampling.** Following installation of a temporary boring, a 48-inch long, 1.25-inch-diameter stainless-steel screen will be installed in the bottom of the borehole to keep the borehole open in case it collapses. The outer drill rods will be retracted approximately 2 feet (thereby collecting a groundwater sample at the interface of the Linn Gravels and the Spencer Formation), and the sampling screen will be exposed. Methods for collecting groundwater samples are discussed in Section 3.1.2.
- **Groundwater Sample Analysis.** Groundwater samples will be analyzed for volatile organic carbons by EPA Method 8260B at a mobile laboratory.
- **Boring Abandonment and Decontamination.** Temporary borings will be abandoned in accordance with Oregon regulations within 72 hours of initial construction<sup>4</sup>. Drill rods and reusable well screens will be cleaned onsite using a brush and an alconox and tap water wash solution before advancing a boring. Equipment will be rinsed with tap water and then steam cleaned inside and out. The cleaned equipment will be stored on clean storage racks for reuse.

## 2.3 Feasibility of Remediating CVOC Sources Beneath Structures

If the investigation into the areal extent of the source zone (Section 2.2) indicates a CVOC source beneath the acid tank or the possibility of CVOCs extending beneath other structures (based on results near structure perimeters), ATI may, in the future, attempt to remediate the source by introducing injectate beneath or near the boundaries of the acid tank and near structures. Specifically, concentrations of TCA in groundwater indicate that a source area may be present beneath the aboveground storage tanks and the Acid Sump building (see Figure 2). Introducing injectate beneath the aboveground storage tanks in particular is challenging in the Acid Sump Area because the tanks are located on a groundwater divide (see Figure 4) and the Site geology is highly heterogeneous. Therefore, after delineation of CVOC extent, ATI will consider conducting a tracer test with the purpose of evaluating the feasibility of exposing the source zone beneath structures to injectate based on radiuses of influence and viability of recirculation.

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<sup>4</sup> Oregon Administrative Rule (OAR) 690-240.

### 2.3.1 Data Gap Description

Methods for introducing injectate beneath structures consists of either:

- Injecting on one side of a structure while simultaneously extracting on the other side, to pull the injectate underneath the structure to allow the injectate to contact the source zone.
- Injecting near the boundaries of structures in numerous locations where sufficient radius of influence of injectate allows for contact with the source zone.

ATI proposes an observational approach (i.e., tracer test) to assessing the feasibility of exposing a source zone beneath structures to injectate because other approaches (e.g., analytical or numerical modeling) are likely to be inaccurate given the highly heterogeneous, anisotropic nature of the geology at the Site.

### 2.3.2 Methods for Addressing Data Gap

If the CVOC source investigation determines NAPL appears to be present under the tank pad south of the 2016 excavation and the assessment of the current well network indicates the wells are poor candidates for a tracer test, ATI will drill new wells to conduct a tracer test. The objective of a tracer test would be to (1) assess the radius of influence of injectate and (2) the feasibility of exposing the source zone beneath the structures to injectate. ATI assumes up to two new wells initially may be installed; however, remediation may involve additional wells based on the source zone investigation. The following bullets describe these activities in greater detail.

- **Well Installation.** Wells will be installed at future-determined locations in the Acid Sump Area. Wells will be completed in the Linn Gravels using drilling techniques dependent on Site conditions (i.e., access and geological constraints) and conform to Oregon standards for monitoring well construction. The preliminary design for injection and extraction wells is listed below<sup>5</sup> and may be adjusted on the basis of drilling technique.
  - Installed to the top of the Spencer Formation (total depth of approximately 15 to 17 feet bgs).
  - 8-inch-diameter boring, or smaller, based on drilling technique.
  - Completed with 4-inch-diameter inside diameter (ID) casing, or smaller, based on drilling technique. The casing material (stainless steel or Schedule 40 polyvinyl chloride [PVC]) will be dependent on screening concentrations and will be selected in accordance with EPA guidance (EPA, 1995).
  - Completed with 4-inch-diameter pipe size screen, or smaller, based on drilling technique, from 5 feet above top of Spencer Formation to the bottom of the well. The screen material (Type 304/316 stainless steel or PVC) will be dependent on screening concentrations in accordance with EPA guidance

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<sup>5</sup> Well design will be finalized on the basis of soil grain size sample(s) collected as a part of the DNAPL extent evaluation and soil logging from boreholes.

(EPA, 1995). The slot size will be determined on the basis of a soil grain size sample collected from a temporary boring advanced as a part of the source zone delineation (Section 2.2).

- Colorado Silica Sand filter pack from 8 feet bgs to the bottom of the well. The gradation of the filter pack will be based on a soil grain size sample collected from a temporary boring advanced as part of the source zone delineation (Section 2.2).
- Dry-poured sodium bentonite granules, pellets or chips (greater than ¼-inch), will be placed from ground surface to 8 feet bgs and hydrated with potable water in 2-foot lifts<sup>6</sup>.
- Completed with a heavy-traffic flush mount monument.

Following construction, wells will be developed by surging and pumping. The duration of the development period will be determined by the supervising field technician based on stabilization of specific conductance (SC) in groundwater<sup>7</sup> dependent on water recharge. Stabilized SC measurements provide further confidence that representative groundwater samples will be collected.

- **Aquifer Test.** Following installation of the wells, ATI will conduct a 24-hour constant-rate aquifer test by pumping the well and observing groundwater elevation changes in any adjacent monitoring points. The aquifer test will be used to calculate hydraulic conductivity, which will be used to determine the expected duration of the tracer test, and well spacing (if injection and extraction well pairs are to be installed as part of future remediation). Based on previous constant-rate pumping tests in the Fabrication Area (CH2M HILL, 1993), it is anticipated that the extraction well will be pumped at a rate of approximately 1 gallon per minute (gpm; pumping rate will be based on a step-rate test conducted before the constant-rate test).
- **Tracer Test.** The objectives of the tracer test are: (1) determine radius of influence of injection materials, (2) determine reductions in injectate concentrations caused by dispersion, and (3) measure groundwater velocity during injection and extraction attempts. The locations of tracer will be determined on the basis of the wells used, if new wells are installed, and the results of the CVOC source area evaluation.

The tracer test will be conducted using fluorescent or ionic tracers. An evaluation of the suitability of fluorescent and ionic tracers for tracer testing in the Acid Sump Area is presented in Appendix A. The tracer selected for the test will be appropriate for use given groundwater pH in the Acid Sump Area<sup>8</sup>, will be conservative<sup>9</sup>, and

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<sup>6</sup> See OAR 690-240-0475.

<sup>7</sup> SC will be considered to have stabilized when it changes by less than 3 percent between readings (if SC is less than 100 micro Siemens per centimeter [ $\mu\text{S}/\text{cm}$ ]) or when it changes by less than 5 percent between readings (if SC is more than 100  $\mu\text{S}/\text{cm}$ ). Readings are measured about every 0.5 gallon of purged water.

<sup>8</sup> Most fluorescent dyes are generally not suitable tracers when pH is below 5 (specifically, the fluorescence of dyes decreases rapidly when pH is below 5 [Davis et al., 1985; YSI, 2001]). Before buffering Acid Sump Area groundwater with sodium bicarbonate as a part of the EISB remediation, groundwater pH was reported to range from 4.5 to 6.3 (GSI, 2009). Therefore, fluorescent dyes may not be suitable for tracer testing in portions of the Acid Sump Area where groundwater has not been buffered.

<sup>9</sup> A tracer is conservative if it does not sorb on aquifer solids and does not degrade.

will occur at low background concentrations in groundwater<sup>10</sup>. Table 1 provides characteristics of tracers that are considered to be potentially suitable for use in the Acid Sump Area based on the information presented in Appendix A. Final tracer selection will be made following collection of pH, chloride, and bromide data from Acid Sump Area wells, and may include tracers not shown in Table 1 (based on additional research). Note that FLT dyes (yellow/green, red, and blue) were used in the Acid Sump Area in 2009 for qualitative purposes with mixed results (GSI, 2011)<sup>11</sup>.

**Table 1. Characteristics of Potentially Suitable Tracers for Tracer Testing in the Acid Sump Area**

Tracer Name	Stable pH Range	Susceptibility to Sorption	Background Concentrations in Groundwater (mg/L)
Rhodamine WT Dye	5 to 10 <sup>1</sup>	Moderate (28% Loss) <sup>3</sup>	0.0
Xanthene Dye (FLT Yellow/Green)	6 to 11 <sup>2</sup>	Unknown	0.0
Chloride	1 to 14	Low <sup>3</sup>	8.9 to 680
Bromide	1 to 14	Low <sup>3</sup>	No data

**Notes:**

<sup>1</sup>Feuerstein and Sellek (1963)

<sup>2</sup>Bright Dyes (2019)

<sup>3</sup>Davis et al. (1985)

mg/L = milligrams per liter

Tracer testing will involve the following steps:

1. Collect groundwater samples from select wells and analyze the samples for CVOs, chloride, and bromide at Apex Laboratories in Tigard, Oregon, and/or using a mobile laboratory. The groundwater pH will be measured in the field. Select a tracer based on the results.
2. Establish the steady-state hydraulic field that is created by simple injection and/or simultaneously injecting and extracting. Potable water will be injected in the injection wells, and extracted water will be treated by sparging with a temporary groundwater treatment system, stored in a post-treatment tank after sparging, and hauled to the Site's central wastewater treatment system (CWTS). Investigative Derived Waste is discussed further in Section 3.6.
3. Mix tracer into a mixing vessel (drum or tank) using a continuous feed pump, and convey tracer-laden water into the injection well using a transfer pump and

<sup>10</sup> Chloride concentrations ranged from 8.85 milligrams per liter (mg/L) (PW-13) to 680 mg/L (TMW-4) in the Acid Sump Area during the 2016 sitewide monitoring event, with most results being less than 20 mg/L. Background chloride concentrations may be too high because ionic tracer concentrations must be less than 3,000 mg/L to prevent density-dependent flow (Davis et al., 1985).

<sup>11</sup> FLT yellow/green, blue, and red dyes were used. All three dyes were injected into the same well (I-2) and qualitatively monitored for presence/absence in downgradient observation wells. The yellow/green dye was observed in downgradient monitoring wells, and the blue and red dyes often were not observed, indicating that the blue and red dyes are not suitable for tracer testing in the Acid Sump Area.

slotted drop pipe installed into the well. The tracer test will be conveyed to the well during at least a few hours, depending on the ability of the injection well to accept water. The tracer concentration will be determined after selection of the tracer types, and will be subject to the following criteria:

- Concentration of ionic tracers will be less than 3,000 mg/L to avoid density-dependent flow (Davis et al., 1985).
  - Tracer concentration may decrease by a factor of 100 during transport because of dilution and dispersion (see calculations based on the Advection Dispersion Equation in Appendix B).
4. The tracer test may last up to about 50 days, as outlined in the preliminary estimate of peak tracer arrival in Appendix B, with the first-arrival of tracer in about 2 or 3 weeks. It is also possible, due to preferential pathways, that the tracer may be seen at the receiving well more rapidly. As the actual travel time is unknown, tracer concentrations will be data logged continually throughout the test using automated equipment (e.g., a Yellow Springs Instruments [YSI] 6130 Rhodamine WT fluorometer, conductivity probe, or ion-selective electrode for bromide or chloride). This will eliminate the need for field personnel to continually monitor the tracer test but rather periodically download the data until test completion. Peak arrival is necessary to determine average linear groundwater velocity and dispersivity. ATI may halt the tracer test before peak arrival depending on actual test length, or for other unanticipated conditions.

## 2.4 Performance of Existing Injection and Extraction Wells

In 2009, ATI installed 12 wells in the Acid Sump Area for injecting and/or extracting substrate and microbes as a part of the EISB remediation. Eleven of the 12 wells still exist (I-1 was removed during the 2016 soil excavation). The wells are 2-inch-diameter PVC completed with 20 slot prepacked (8/12 Colorado Silica Sand) screens.

### 2.4.1 Data Gap Description

The current performance of the EISB injection and extraction wells (i.e., the rate at which they can inject remedial agents) and current condition are unknown. Therefore, it is unknown if these wells can be used for future injections or extractions, or if new wells need to be installed.

### 2.4.2 Methods for Addressing Data Gap

ATI will measure the performance of these wells by conducting short-duration water or water with tracer-only injection tests at each well. Injections will occur with flow rates between 0.5 and 1.5 gallons gpm and at pressure less than 6 pounds per square inch (psi) during a 20-minute period. ATI will record the volume of water that is injected, and compare the volumes to injection performance data collected in 2009 to assess current well performance (GSI, 2011). No injections will be made into well E-12 because of proximity to Manhole #3.

### 3. Sampling Protocols

The following section discusses procedures that will be used when implementing this Work Plan. Specifically, it documents sampling methods, sample nomenclature, laboratory analysis, quality control (QC) samples, and management of investigation derived waste (IDW).

#### 3.1 Groundwater Sampling Methods

Groundwater samples will be collected from permanent wells and temporary wells.

##### 3.1.1 Groundwater Sampling at Permanent Wells

Groundwater samples collected from permanent monitoring wells and injection or extraction wells using a low-flow sampling methodology (Puls and Barcelona, 1996; Wilde et al., 1998)<sup>12</sup>. Groundwater will be purged with a peristaltic pump and dedicated polyethylene tubing placed about 1 foot below the top of the saturated well screen (or lower if the top of the well screen is unsaturated). During purging, depth to groundwater, purge rate, and groundwater field parameters (i.e., temperature, pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], and SC) will be monitored using a YSI multiparameter instrument with an enclosed flow-through cell. Groundwater samples will be collected after field parameters and turbidity have stabilized. Field parameter stabilization criteria are:

- Temperature: +/- 0.2 degrees Celsius
- DO: +/- 0.3 mg/L
- ORP: +/- 10 millivolts
- pH: +/- 0.1
- SC: +/- 3 percent  $\mu\text{S}/\text{cm}$

##### 3.1.2 Groundwater Sampling at Temporary Boring Locations

Groundwater samples at temporary borings will be collected using a peristaltic pump with dedicated polyethylene tubing. The tubing will be installed into the saturated well screen. Grab samples will be collected without reaching the stabilization criteria discussed in Section 3.1.1.

#### 3.2 Soil Sampling Methods

Soil from all locations will be logged using continuous core soil sampling equipment to develop a geologic profile and to provide the field team with the opportunity to collect soil samples as necessary in the field based on visual observation and PID readings. However, as groundwater samples will be more representative of source zone impacts below the water table, soil collection and analysis will be limited to vadose zone soils with indications

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<sup>12</sup> These procedures do not apply to groundwater samples collected during the tracer test for analysis of tracer concentration. These samples will be grab samples, collected while the injection/extraction system is operating.

of significant visible NAPL staining. For soil samples to be analyzed by the mobile laboratory, samples will be collected in a 4-ounce glass jar at an indicated depth or depth range of CVOC impacts. If samples require shipping to a fixed laboratory, they shall be collected in accordance with the Quality Assurance Project Plan (QAPP; GSI, 2016). Sampling methods, hold times, and preservation methods are discussed further in Section 3.4.

### 3.3 Sample Nomenclature

Soil and groundwater samples will be labeled with a unique sample name and collection date. The name convention will follow the format for groundwater “GW-XXXX-YYMM” where “GW” denotes that the sample is a groundwater sample, “XXXX” denotes the sampled borehole name (i.e., BH13), and YYMM denotes the year and month. The name convention will follow the format for soil “SB-XXXX-ZZ-YYMM” where “SB” denotes that the sample is a soil boring sample, “XXXX” denotes the sampled borehole name (i.e., BH13), ZZ indicates the top of sampling interval (i.e., 14 for 14 feet bgs), and YYMM denotes the year and month. For example, a groundwater sample collected from borehole 13 during investigative sampling will be labeled “GW-BH13-Date.” If a soil sample is collected from the 14 feet bgs to 15 feet bgs interval, then the sample would be “SB-BH13-14-Date.”

### 3.4 Laboratory Analysis

Table 2 shows laboratory methods, sample containers, preservatives, holding times, and target reporting limits for soil and groundwater sampling. Samples will be analyzed in the field using a mobile laboratory.

**Table 2. Analytical Requirements for Characterization Samples**

Parameter	Analytical Method	Target Reporting Limit	Sample Container	Sample Preservation	Holding Time
<i>Groundwater Samples</i>					
Volatile Organic Compounds (VOCs)	EPA 8260B	0.5 µg/L	(3) 40 mL VOA vials w/ Teflon-lined septum	NA	NA
<i>Soil Samples</i>					
Volatile Organic Compounds (VOCs) – Mobile Laboratory	EPA 8260B	0.5 mg/kg	4-oz glass jar	Cool to < 6°C	48 hours
Volatile Organic Compounds (VOCs) – Off-site Laboratory	EPA 8260B	0.5 mg/kg	2-oz glass jar w/ Teflon lined cap	Cool to < 6°C	7 days

Notes:

°C = degrees Celsius

EPA = U.S. Environmental Protection Agency

mg/kg = milligrams per kilogram

mL = milliliter

NA = not applicable

oz = ounce

VOA = volatile organic analysis

### 3.5 Field Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be collected during the sampling event. One duplicate groundwater sample will be collected for every 20 groundwater samples collected or one for each sampling field day, whichever is greater, as outlined in the QAPP (GSI, 2016)<sup>13</sup>. This same QA/QC protocol will be applied to samples collected from injection/extraction wells and tracer samples, if applicable. That QA/QC protocol is not applicable is groundwater samples analyzed for tracer concentrations, because the tracer concentration will be analyzed continuously using a sensor and datalogger. Duplicates will be collected by filling an extra set of sample bottles at the time of collection and assigning a different sample identification to a mobile laboratory.

Sample labels will be affixed to each sample container and follow the sample identification system outlined in the QAPP (GSI, 2016). A fictitious identification number (e.g., GW-Dup-1-YYMM) and sample time will be assigned to field duplicate samples.

<sup>13</sup> Note that this does not apply to groundwater samples collected from injection and extraction wells as a part of the tracer test (including CVOs and tracer).

### 3.6 Investigation Derived Waste

IDW, including drill cuttings, decontamination water, and purge water, will be transferred to 55-gallon drums, labeled, and stored onsite. Appropriate IDW disposal will be dependent on soil and groundwater analytical results.

- Investigation debris: During air knifing, asphalt pavement will be removed and debris and concrete may also be encountered. These materials will be transported to the Schmidt Lake Excavation Project (SLEP) soil treatment pad and processed in the debris handling area.
- Purge, sampling, and decontamination water: At the completion of the sampling event, samples will be collected from the drum(s) and be tested by the mobile laboratory to determine VOC concentrations. If concentrations are below Site's target treatment concentrations (listed below in Table 3), IDW water will be discharged to the Site's CWTS. Otherwise, one of two procedures will be followed dependent upon IDW water volume. Either the water will be disposed off-site at an appropriate disposal facility for VOC concentrations or a small air stripper system will be mobilized. If an air stripper is mobilized, water will be extracted from a drum, processed through the air stripper, and discharged into a second drum. This process will be repeated until analytical results confirm that the Site's target treatment concentrations have been achieved. At that time, the treated water will be discharged to the Site's CWTS.

**Table 3. CWTS Target Treatment Concentrations for IDW Water**

Parameter	Influent Target Treatment Concentration for CWTS (µg/L)
1,1,1-TCA	280,000
1,1-DCA	36,000
1,2-DCA	1,000
Chloroethane	13,000
TCE	2,000
Cis-1,2-DCE	1,000
Trans-1,2-DCE	1,000
1,1-DCE	20,000
VC	1,000
PCE	1,000

Notes:

µg/L = microgram per liter

- Soil cuttings: Soil cuttings will be staged at the SLEP soil treatment pad. A grab IDW soil sample will be analyzed for each drum) and analyzed by the mobile laboratory during and/or immediately following the investigation. Results will be compared to the Oregon Department of Environmental Quality's (DEQ) risk-based concentrations for soil ingestion, dermal contact, and inhalation exposure pathway for occupational receptors (shown in Table 4). If the result(s) is above the DEQ risk-based concentrations, cuttings will be removed from drums, mixed, and aerated until analytical results demonstrate that they meet or are below the DEQ risk-based

concentrations and will then be sent to a Resource Conservation and Recovery Act Subtitle D landfill.

**Table 4. Target Treatment Concentrations for IDW Soils**

Parameter	DEQ Risk-Based Concentration (ppm)
TCA	870,000
DCA	260
TCE	51
DCE	29,000
cis-DCE	2,300
VC	4.4

Notes:

Based on soil ingestion, dermal contact, and inhalation for occupational receptors.

ppm = parts per million

DEQ = Oregon Department of Environmental Quality

## 4. Reporting

The following two documents will be prepared after the work described in this Work Plan is completed:

- **Remedial Action Plan.** This document will summarize the results of the Work Plan, evaluate the feasibility of source zone treatment in the Acid Sump Area, and present a detailed work plan for implementing the remedy. The Remedial Action Plan may include additional sampling required to finalize the approach before implementation.
- **Remedial Action Report.** Final report documenting remedial actions.

## 5. References

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**FIGURE 2**  
**Concentrations of TCA**  
**in Acid Sump Groundwater**  
*ATI Millersburg Operations, Oregon*

**LEGEND**

**Permanent Wells**

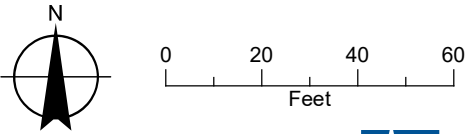
- Monitoring Well  
68.5 TCA in ug/L (Spring 2018)
- EISB Injection / Extraction Well  
1,800 TCA in ug/L (Spring 2018)

**Temporary Wells**

- Temporary Boring  
670 TCA in ug/L (2008/2009)
- EISB Biobarrier Well  
2.34 TCA in ug/L (2009)
- Original Acid Sump Location
- Estimated Potential Extent of NAPL
- Approximate Excavation Area
- Railroad

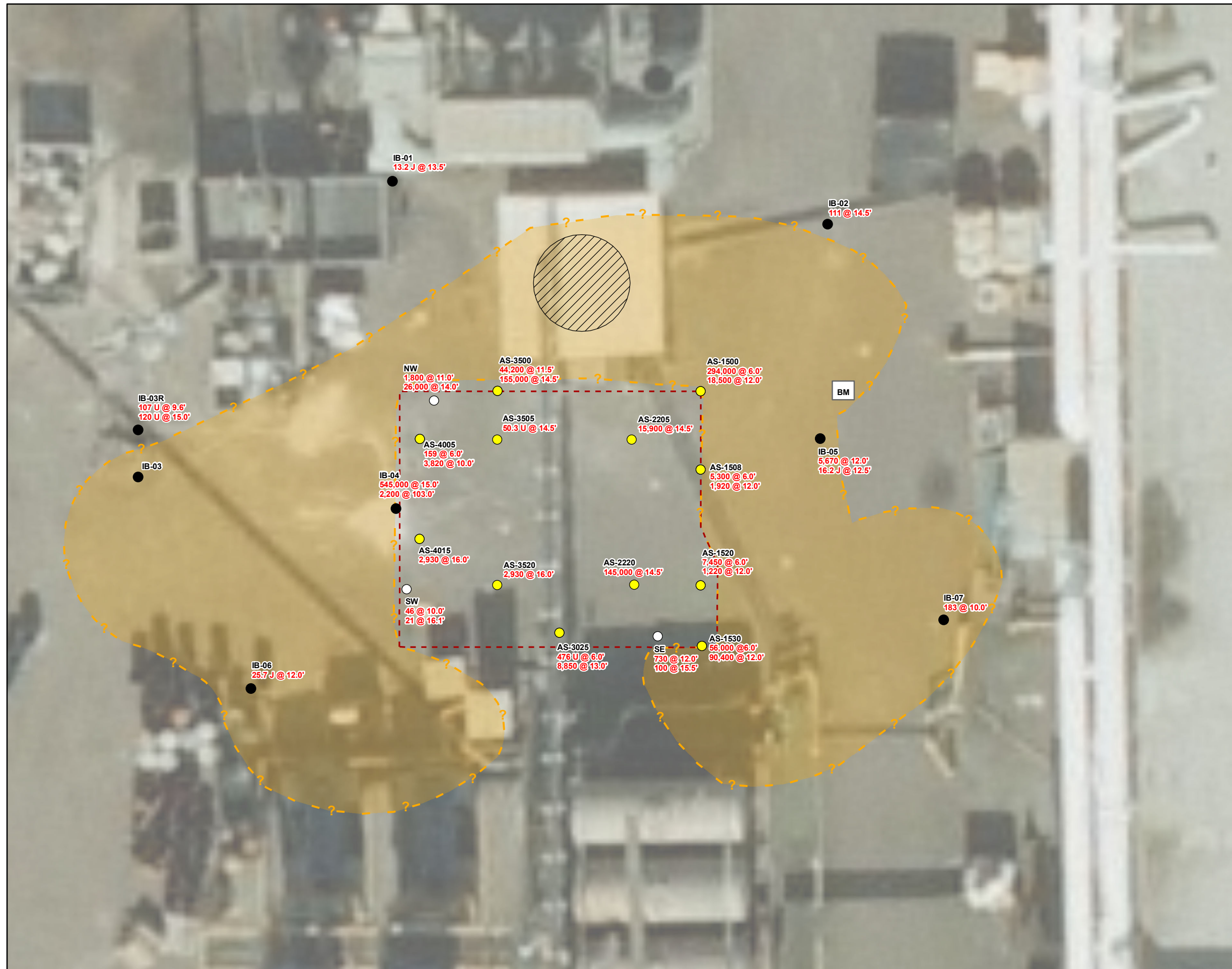
**NOTES:**

- TCA: 1,1,1-Trichloroethane  
U: Compound not detected  
J: Estimated concentration
- TCE and TCA concentrations from temporary geoprobe wells 1, 2, 24, and 25 are from samples collected on July 6, 2009.
  - TCA from IB borings are from a November-December 2008 sampling event conducted by Geosyntec.
  - TCE and TCA concentrations in monitoring wells are from 2016 and 2018 groundwater sampling events, whichever is most recent.
  - Well locations are approximate.



Date: October 15, 2019  
Data Sources: Wah Chang, City of Albany GIS

**FIGURE 3**  
**Concentrations of TCA in**  
**Acid Sump Soil**  
*ATI Millersburg Operations, Oregon*



**LEGEND**

- Geosyntec Temporary Boring (2009)  
716 TCA in ug/kg at Depth Below Ground (ft)
- Excavation Confirmation Sample (2016)  
5,300 TCA in ug/kg at Depth Below Ground (ft)
- Soil Excavation Predesign Sample (2015)  
730 TCA in ug/kg at Depth Below Ground (ft)
- ⊘ Original Acid Sump Location
- Estimated Potential Extent of NAPL
- Approximate Excavation Area
- +— Railroad

**NOTES:**  
TCA: 1,1,1-Trichloroethane  
U: Compound not detected  
J: Estimated concentration

- "AS" samples are from the "Acid Sump Area Soil Excavation Construction Report" dated May 5, 2017.
- "SW Samples are from the "Acid Sump Area Source Area Remedial Action Plan" dated January 8, 2016.
- "IB" borings are from the "Design Investigation and Remedy Selection Report" dated March 18, 2009.



**FIGURE 4**  
**Areas for Additional**  
**Exploration**  
*ATI Millersburg Operations, Oregon*

**LEGEND**

**Permanent Wells**

- Monitoring Well
- EISB Injection/Extraction Well

**Temporary Wells**

- Temporary Boring

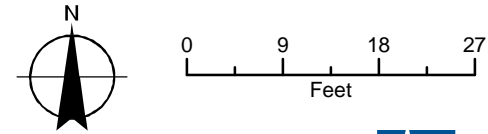
**All Other Features**

- Groundwater Flow Direction
- Original Acid Sump Location
- Approximate Excavation Area
- General Boring Investigation Area

**NOTES:**

1. "IB" borings are from the "Design Investigation and Remedy Selection Report" dated March 18, 2009.

2. Temporary borings TMW-1 and TMW-4 were converted to permanent monitoring wells and then removed during the 2016 soil excavation.



**Appendix A**  
*Evaluation of Suitability of Ionic and Fluorescent Tracers in the Acid Sump  
Area for Tracer Testing*

## Appendix A. Evaluation of Suitability of Ionic and Fluorescent Tracers in the Acid Sump Area for Tracer Testing

ATI Millersburg Operations, Oregon

Tracer Class	Tracer	Other Names	Color	Stable pH Range	Potential Quenching Agents	Susceptibility to Sorption and/or Ionic Exchange	Susceptibility to Biological Decay	Toxicity
<b>Suitable Tracers</b>								
Fluorescent Dyes	Rhodamine WT		Orange	5 - 10 (1)	Chlorine (2)	Moderate (28% loss) (2), (4)	Low (4)	Moderate (4)
	Xanthene	FLT Yellow/Green	Yellow/Green	6 - 11 (3)	No Data	Low (3)	No Data	No Data
Ionic Tracers	Chloride (Cl <sup>-</sup> )		Colorless	1 - 14	NA	Low (4)	None (4)	Low (4)
	Bromide (Br <sup>-</sup> )		Colorless	1 - 14	NA	Low (4)	None (4)	Low (4)
<b>Non-Suitable Tracers</b>								
Fluorescent Dyes	Rhodamine B		Orange	5 - 10 (5)	Suspended Solids (4)	High (98% loss) (4)	No Data	High (4)
	Sulfo Rhodamine B	Pontacyl Pink B Lissamine Red 4B Kiton Rhodamine B Acid Rhodamine B	Orange		Chlorine (7)	High (65% loss)	No Data	High (4)
	Fluorescein	Uranin, Sodium Fluorescein, Pthalien	Green	> 6 (1)	No Data	High (4)	No Data	No Data
	Amino G Acid	Disulphonic Acid	Blue	> 6 (4)	No Data	No Data	No Data	Low (6)
	Photine CU		Blue	> 6 (4)	No Data	No Data	No Data	Low (6)
Ionic Tracers	Lithium (Li <sup>+</sup> )		Colorless	1 - 14	NA	High (4)	None	No Data
	Ammonium (NH <sub>4</sub> <sup>+</sup> )		Colorless	1 - 14	NA	High (4)	None	No Data
	Magnesium (Mg <sup>2+</sup> )		Colorless	1 - 14	NA	High (4)	None	No Data
	Potassium (K <sup>+</sup> )		Colorless	1 - 14	NA	High (4)	None	No Data
	Iodide (I <sup>-</sup> )		Colorless	1 - 14	NA	High (4)	None	No Data

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- (5) Knuttson, 1968.

## **Appendix A. Evaluation of Suitability of Ionic and Fluorescent Tracers in the Acid Sump Area for Tracer Testing**

### ***ATI Millersburg Operations, Oregon***

(6) Akamatsu and Matsuo, 1973.

(7) Otz, M. H., D. Siegel, E. Hinchey, I. Otz, and H. K. Otz. Fluorescent Dye-Tracing as a Cost-Effective Tool in Applied Contaminant Hydrology: A Case Study of Synchronous Spectro-Fluorometry in Heavy-Oil Contaminated Aquifer.

**Appendix B**  
*Racer Arrival and Attenuation Caused by Dispersion and Dilution*

Appendix B. Tracer Arrival and Attenuation Caused by Dispersion and Dilution  
ATI Millersburg Operations, Oregon

Initial Concentration, C <sub>0</sub> (mg/L)	Distance, x (feet)	Flow Path Length, L (feet)	Hydraulic Conductivity, K (feet/day)	Effective Porosity, h <sub>e</sub> (dimensionless)	Hydraulic Gradient (feet/feet)	Velocity, v (feet/day)	Time, t (days)	Dispersivity, a (feet)	Dispersion Coefficient, D (feet <sup>2</sup> /day)	A <sub>1</sub>	B <sub>1</sub>	C (x, t) (mg/L)
1,000	80	80	1.5	0.1	0.11	1.6875	5	8	13.5	3.4E+01	-19.0	2.0E-07
1,000	80	80	1.5	0.1	0.11	1.6875	10	8	13.5	2.4E+01	-7.4	1.5E-02
1,000	80	80	1.5	0.1	0.11	1.6875	15	8	13.5	2.0E+01	-3.7	4.9E-01
1,000	80	80	1.5	0.1	0.11	1.6875	20	8	13.5	1.7E+01	-2.0	2.4E+00
1,000	80	80	1.5	0.1	0.11	1.6875	25	8	13.5	1.5E+01	-1.1	5.3E+00
1,000	80	80	1.5	0.1	0.11	1.6875	30	8	13.5	1.4E+01	-0.5	8.2E+00
1,000	80	80	1.5	0.1	0.11	1.6875	35	8	13.5	1.3E+01	-0.2	1.0E+01
1,000	80	80	1.5	0.1	0.11	1.6875	40	8	13.5	1.2E+01	-0.1	1.1E+01
1,000	80	80	1.5	0.1	0.11	1.6875	45	8	13.5	1.1E+01	0.0	1.1E+01
1,000	80	80	1.5	0.1	0.11	1.6875	50	8	13.5	1.1E+01	0.0	1.1E+01
1,000	80	80	1.5	0.1	0.11	1.6875	55	8	13.5	1.0E+01	-0.1	9.8E+00
1,000	80	80	1.5	0.1	0.11	1.6875	60	8	13.5	9.9E+00	-0.1	8.6E+00
1,000	80	80	1.5	0.1	0.11	1.6875	65	8	13.5	9.5E+00	-0.3	7.4E+00
1,000	80	80	1.5	0.1	0.11	1.6875	70	8	13.5	9.2E+00	-0.4	6.2E+00
1,000	80	80	1.5	0.1	0.11	1.6875	75	8	13.5	8.9E+00	-0.5	5.2E+00
1,000	80	80	1.5	0.1	0.11	1.6875	80	8	13.5	8.6E+00	-0.7	4.3E+00
1,000	80	80	1.5	0.1	0.11	1.6875	85	8	13.5	8.3E+00	-0.9	3.5E+00
1,000	80	80	1.5	0.1	0.11	1.6875	90	8	13.5	8.1E+00	-1.1	2.8E+00
1,000	80	80	1.5	0.1	0.11	1.6875	95	8	13.5	7.9E+00	-1.3	2.2E+00
1,000	80	80	1.5	0.1	0.11	1.6875	100	8	13.5	7.7E+00	-1.5	1.8E+00
1,000	80	80	1.5	0.1	0.11	1.6875	110	8	13.5	7.3E+00	-1.9	1.1E+00
1,000	80	80	1.5	0.1	0.11	1.6875	120	8	13.5	7.0E+00	-2.3	6.9E-01
1,000	80	80	1.5	0.1	0.11	1.6875	130	8	13.5	6.7E+00	-2.8	4.2E-01
1,000	80	80	1.5	0.1	0.11	1.6875	150	8	13.5	6.3E+00	-3.7	1.5E-01
1,000	80	80	1.5	0.1	0.11	1.6875	170	8	13.5	5.9E+00	-4.7	5.6E-02
1,000	80	80	1.5	0.1	0.11	1.6875	190	8	13.5	5.6E+00	-5.6	2.0E-02
1,000	80	80	1.5	0.1	0.11	1.6875	210	8	13.5	5.3E+00	-6.6	6.9E-03

**Notes:**  
amsl = above mean sea level  
mg/L = milligrams per liter  
Flow path length is the distance from extraction wells to injection wells, underneath the acid tanks.  
Hydraulic conductivity is median value estimated from single-well pumping tests in the Linn Gravel, Fabrication Area.  
Hydraulic gradient assumes water is 1 foot below ground surface at the injection well (about 206.35 amsl)  
and 1 foot above the top of screen at the extraction well (about 197.35 feet amsl).  
Dispersivity estimated using the 10 percent rule from Gelhar (1992).

